Conformance Test Framework for Government Smart Card

A white paper

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INTRODUCTION

The purpose of this paper is to present general concepts, components, and issues related to establishing and administering a conformance testing and certification program for the Government Smart Card (GSC) program. It will identify roles, types of activities, responsibilities, and services. Specific options and recommendations for the GSC Conformance Testing Program will be prefixed with "**".

BACKGROUND AND SCOPE

The interagency agreement for NIST support of the Government Smart Card program calls for NIST to develop a comprehensive conformance test program. NIST is also leading the effort to develop the underlying GSC Interoperability Specification (GSC-IS).

The comprehensive conformance test program consists of (1) the design and implementation of the conformance test code and the supporting tools and procedures, and (2) the certification infrastructure to enable the proper validation and certification of products conforming to the GSC-IS. This paper addresses the validation and certification process for the GSC program.

CONFORMANCE TESTING DEFINED

Conformance testing is defined as testing to see if a product meets the requirements of the standard or specification that the product is supposed to implement. There are other types of testing, including testing for performance. However, conformance testing has one main characteristic: conformance requires a specification and a definition of what it means to conform to the specification, typically in the form of conformance clause.

Conformance testing is "black box" testing which tests the functionality of an implementation. This means that the internal structure or the source code of a candidate implementation is not examined.

For the purpose of this document, other relevant terms and definitions are explained as follows:

- Validation is the process of testing software for conformance to a specific specification.
- Certification is the acknowledgement that a validation has been completed and the criteria established by the certifying organization have been met.
- Accreditation is the procedure by which an authoritative body gives formal recognition that an organization or person is competent to carry out validation.

** "Products" in the GSC context are the smart cards themselves, and the software/hardware systems produced by smart card vendors that adhere to the GSC Interoperability Specification.

RATIONALE FOR CONFORMANCE TESTING

Conformance testing can

- Increase a buyer's (user's) confidence that a product does what it says it does.
- Provide an independent, objective method for evaluating products.
- Be a prerequisite for achieving interoperability among implementations.

Conformance tests should be developed and used as early as possible in the development process to improve the quality of future specifications and resulting implementations. The overall goal of conformance testing is to provide the users of conforming products some assurance or confidence that the product behaves as expected, and is not a way to judge if one product is better than another.

COMPONENTS OF CONFORMANCE TESTING

A conformance testing program usually includes the following components:

- A standard or a specification which includes a conformance clause,
- A conformance test suite, and
- A validation and certification process.

Conformance Clause

The conformance clause of a standard or a specification is a high-level description of what is required of implementations to be considered in conformance with the specification. The conformance clause may specify minimal requirements for certain functions and may specify the permissibility of extensions, options, and alternative approaches and how they are to be handled.

** For the GSC program, the specification, which includes a conformance clause in Chapter 1, is the Government Smart Card Interoperability Specification, Version 2.

Conformance Test Suite

A test suite includes:

- Test assertions
- Test cases
- Test scripts and tools
- Procedures for testing.

A test suite can be viewed as a collection of legal and illegal inputs to the implementation being tested, along with the corresponding "expected results."

The starting point for the development of the test suite is a collection of test assertions. Each assertion consists of a description of a single test of an implementation, including the purpose of the test, the pass/fail criteria, and a reference to the section in the specification from which the assertion is derived.

Each assertion leads to one or more test cases, which consist of code and data. Each test case is supported by an automated script or a set of instructions for manual action (i.e., insert card into the card reader). These scripts may be automatically executed by a test harness, which is a program that sequentially runs the test cases.

Procedures for testing describe how the testing is to be done and the instructions for the tester to follow are also needed. The procedures should be detailed enough so that testing of a given implementation can be repeated with no change in test results. The procedures should also contain information on what must be done operationally when failures occur.

** The GSC program includes two conformance test suites: the card edge and BSI test suites. NIST is developing the test suite for Version 2 of the GSC-IS.

VALIDATION AND CERTIFICATION PROCESS

The third component of the conformance testing program is the validation and certification process. In general, validation and certification require the following roles:

- Testing Laboratory
- Certification Authority
- Certificate Issuer
- Control Board

Testing Laboratory

A testing laboratory performs the actual execution of the conformance test suite on a vendor's/developer's implementation. A testing laboratory can be an organization, an individual, or even the vendor himself doing self assessment. A testing laboratory may be accredited by a formal accreditation organization such as NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or else be more informally recognized by the consumer and implementer as qualified to perform the testing. "General requirements for the competence of testing and calibration laboratories" was defined by International Standard ISO/IEC 17025 in 1999.

For each product tested, the laboratory will issue a test report containing information about the vendor, testing environment, test suite version, and the pass/fail of each test case. The laboratory also provides feedback to the control board on problems, and suggests improvements for the conformance testing process.

The testing laboratory and certification authority establishes appropriate fees for performing test. Fees for laboratory testing efforts can be paid by the developer of the product or the consumer. If the developer pays for the testing, the test results are usually kept confidential until the implementation passes.

Certification Authority (CA)

The Certification Authority is the sponsor or owner of the conformance testing program. The CA defines the administrative and operational testing process as well as testing policies and procedures. The CA also maintains the test suite which must evolve with the specification.

Responsibilities of the CA include approval of test suites and testing policies and procedures, establishment of criteria for the testing laboratory, determining the criteria for issuing certificates, and development and maintenance of procedures for the testing laboratory to follow in order to award certificate.

The CA may be a trade association, consortium, standards group, government agency, or private sector company.

Certificate Issuer

The Certificate Issuer is responsible for issuing certificates for validated products. The decision to issue a certificate is based on the testing results and pre-established criteria.

Control Board

The control board is an impartial body of experts who function on behalf of the Certificate Issuer. The control board is responsible for resolving queries and disputes related to the testing process, and ensuring that any technical problems are resolved. In addition, the Control Board maintains records of all queries and resolutions and

disseminates these records on the Web to ensure that all developers have access to the latest information.

The Figure 1 below describes the roles and activities for operating a validation and certification program.

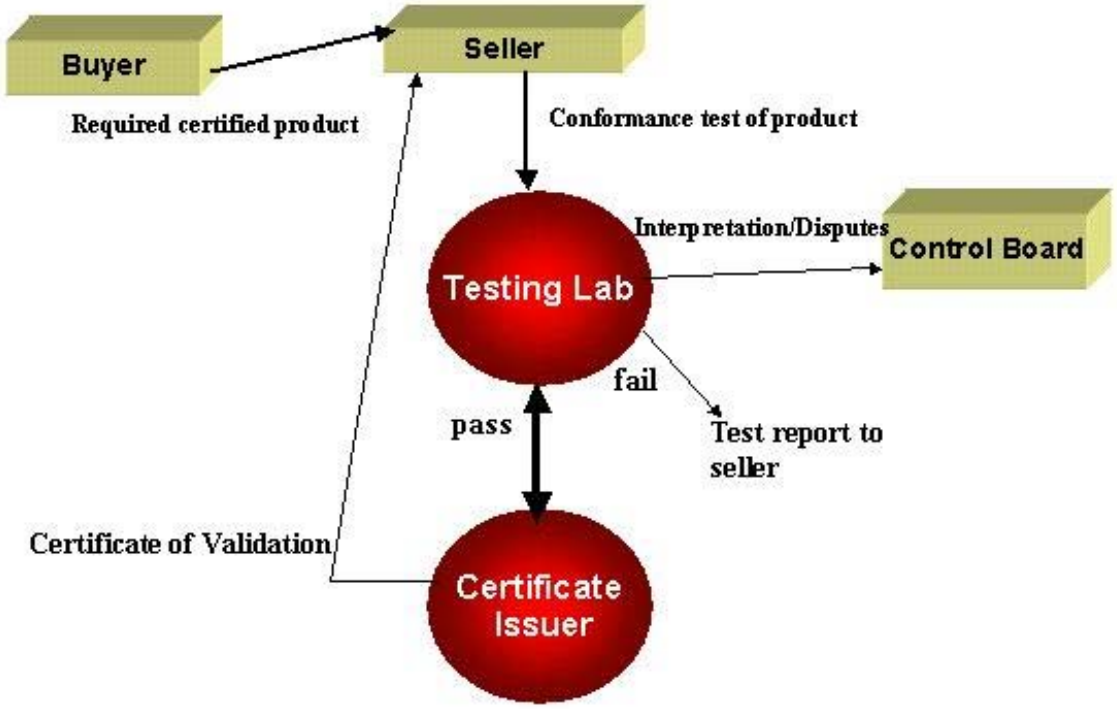

Figure 1 – Validation & Certification Process Flow

**** PROPOSED GSC ROLES AND ACTIVITIES**

Government smart card buyers need to be confident that they are procuring smart cards that conform to GSC Interoperability Specification. Smart card vendors, in order to provide certified products must submit their implementations to a conformance testing process and earn a certificate of conformance.

** We recommend that the **GSC Testing Laboratory** be the Joint Interoperability Testing Center (JITC) of the Department of Defense in Indian Head, Maryland. JITC is already the testing laboratory for the Department of Defense Common Access Card. JITC has agreed to maintain the test suite for the IAB.

An alternative would be for each vendor to do self-testing and claim the test results as part of a contractual declaration.

** We recommend that the **GSC Certificate Issuer** be the same organization as the testing laboratory.

** We recommend that the **GSC Certification Authority** be the Interagency Advisory Board.

** We recommend that the **GSC Control Board** be the Interagency Advisory Board and the Technical Working Group.

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